Tagging New Leaf Rust Resistance Genes in Wheat

Like the Egyptians who built pyramids to immortalize their best citizens, ARS researchers in Manhattan, Kansas, are building pyramids of genes to provide better-lasting resistance to wheat leaf rust.

ARS plant geneticist Gina Brown-Guedira is combining leaf rust resistance found in two ancestors of modern wheat—*Aegilops tauschii* (also known as goatgrass), a weedy wheat relative found from Afghanistan to Syria, and *Triticum timopheevii* from Iran, Iraq, and Turkey—into "gene pyramids." Once built, these gene complexes can be moved into wheat germplasm. Ultimately, varieties having more durable resistance can be developed, which could help farmers gain ground against leaf rust throughout the Great Plains.

Leaf rust is caused by a fungal pathogen called *Puccinia triticinia*. In the 1990s, crop yield losses from leaf rust averaged 5.7 percent in the hard winter wheat growing area of the Great Plains. This translates into average yearly losses of 50 million bushels. Over the decade, the price of wheat averaged $3 a bushel, so leaf rust costs Great Plains farmers about $150 million each year. Not only does leaf rust lessen on-farm yields, it also seriously affects the milling and baking qualities of wheat flour.

In the past, wheat-breeding programs have released resistant varieties, but these wheats possessed only a single leaf rust resistance gene. A few years after release, these varieties usually begin to lose their effectiveness against the rapidly changing *P. triticinia*. The result is a boom-and-bust cycle of disease for farmers in the major wheat-growing areas of the world.

In wheat, Brown-Guedira has identified DNA markers, small pieces of DNA that can be visualized on a gel and are known to be linked to resistance genes. These markers offer a faster way to identify the presence of wheat leaf rust resistance because they can be seen at any stage of plant growth without infecting plants with the fungus.

Scientists currently must use time-consuming classical genetic studies to determine whether a plant has more than one resistance gene. In contrast, Brown-Guedira can test a plant for the presence of several DNA markers. Because the markers are closely linked to the resistance genes, there is a good chance the resistance genes are also present. This work can speed up the task of developing germplasm and varieties with multiple resistance genes.—By **Linda McGraw,** ARS.

Gina Brown-Guedira is in the USDA-ARS Plant Science and Entomology Unit, Kansas State University, Manhattan, KS 66501; phone (785) 532-7260, fax (785) 532-6167, e-mail gbg@ksu.edu. u

Reducing Poultry Crop Breaks

Two ARS scientists are helping to reduce the chances that poultry will become contaminated by pathogenic (disease-causing) bacteria during processing. Physiologist R. Jeff Buhr and agricultural engineer J. Andra Dickens of the Richard B. Russell Research Center in Athens, Georgia, are currently conducting research to reduce crop breakage and the pathogens associated with it.

One significant source of contamination during processing has been the rupture of the bird's crop—a pouch in the neck that stores undigested feed. Crops are known to harbor pathogens like *Salmonella*. The crop is always removed during processing, but it breaks about 25 percent of the time, spilling its contents into and on the chicken.

Buhr and Dickens found two related factors that have bearing on whether crops rupture: the direction in which the crop is removed and the age of the bird at the time of processing. Both factors determine the amount of pressure needed to extract the crop.

For 4-week-old broilers, the researchers found it took 2.72 kg of pulling pressure to remove the crop, whereas at 8 weeks of age, 4.27 kg of pressure was required—a 157-percent increase.

The standard method of pulling the crop from the carcass through the thoracic (chest) cavity also requires greater pulling pressure. Buhr and Dickens found that taking the crop out through the neck resulted in 95 percent of the crops being removed intact. In contrast, only 64 percent of the crops removed through the thoracic cavity exited without rupturing.

Buhr and Dickens say it is too early to recommend changes to the processing industry because their laboratory conditions may not carry through to a commercial setting. In the laboratory, the crop extractions were done manually and not in the automated fashion of poultry processors.

But with a 95 percent intact rate when crops were extracted through the neck, this alternative method should be given consideration in automated commercial evisceration systems, according to Buhr.—By **Sharon Durham,** ARS.

R. Jeff Buhr and J. Andra Dickens are at the USDA-ARS Richard B. Russell Agricultural Research Center, Poultry Processing and Meat Quality Research Unit, 950 College Station Rd., Athens, GA 30604-5677; phone (706) 546-3339, fax (706) 546-3633; e-mail jbuhr@saa.ars.usda.gov adickens@saa.ars.usda.gov. u